

AD-A266 303



0

# Satellite Communications Installation Plan

Howard Meeks

May 1993

DOT/FAA/CT-TN93/1

DTIC  
ELECTE  
JUN 28 1993  
S E D

Document is on file at the Technical Center Library,  
Atlantic City International Airport, N.J. 08405

DS

6 25 226

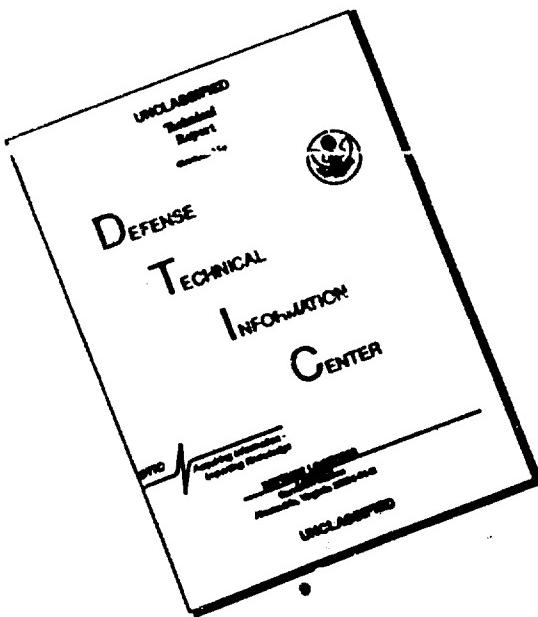
U.S. Department of Transportation  
Federal Aviation Administration

Technical Center  
Atlantic City International Airport, N.J. 08405

93-14616



# **DISCLAIMER NOTICE**



**THIS DOCUMENT IS BEST  
QUALITY AVAILABLE. THE COPY  
FURNISHED TO DTIC CONTAINED  
A SIGNIFICANT NUMBER OF  
PAGES WHICH DO NOT  
REPRODUCE LEGIBLY.**

**NOTICE**

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.

## Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
DOT/FAA/CT-TN93/1			
4. Title and Subtitle		5. Report Date	
SATELLITE COMMUNICATIONS INSTALLATION PLAN		May 1993	
7. Author(s)		6. Performing Organization Code	
Howard J. Meeks		ACD-330	
9. Performing Organization Name and Address		8. Performing Organization Report No.	
Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405		DOT/FAA/CT-TN93/1	
12. Sponsoring Agency Name and Address		10. Work Unit No. (TRAIL)	
Department of Transportation Federal Aviation Administration Automation Systems Division Washington, D.C. 20590		11. Contract or Grant No.	
		T0704F	
15. Supplementary Notes		13. Type of Report and Period Covered	
		Technical Note	
16. Abstract		14. Sponsoring Agency Code	
<p>This installation plan describes the correct installation procedures for installing low rate Satellite Communications (SATCOM) equipment in a Federal Aviation Administration (FAA) Boeing 727 aircraft. The equipment includes an antenna, satellite communications avionics, a data collection computer, and a tape recorder.</p>			
17. Key Words		18. Distribution Statement	
Automatic Dependent Surveillance (ADS) Satellite Communications (SATCOM)		This document is on file at the Technical Center Library, Atlantic City International Airport, New Jersey 08405	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	20	

## TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	vii
INTRODUCTION	1
EQUIPMENT	1
Equipment List	1
SDU	2
RFU	2
ACARS	2
HPA	2
CDU	2
LNA	2
INSTALLATION	2

Accesion For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification .....	
By .....	
Distribution /	
Availability Codes	
Dist	Avail and / or Special
A-1	

S-1000

## LIST OF ILLUSTRATIONS

Figure		Page
1	Aircraft Layout	4
2	Systems Overview	5
3	Systems Block Diagram	6
4	SATCOM Avionics Rack Drawing	7
5	SATCOM Wiring Prints (8 Sheets)	8

## EXECUTIVE SUMMARY

This installation plan describes the correct installation procedures for installing low rate Satellite Communication (SATCOM) equipment in a Federal Aviation Administration (FAA) Boeing 727 aircraft. The equipment includes an antenna, satellite communications avionics, a data collection computer, and a tape recorder.

## INTRODUCTION

This plan describes the installation of the equipment for low rate communications via satellite. The equipment includes an antenna, satellite communications avionics, a data collection computer, and a tape recorder installed in the Federal Aviation Administration (FAA) Boeing 727 (N-40) aircraft.

## EQUIPMENT

1. Satellite Data Unit (SDU)
2. Radio Frequency Unit (RFU)
3. Aircraft Communications Addressing and Reporting System (ACARS)
4. High Power Amplifier (HPA)
5. ACARS Control Display Unit (CDU)
6. SDU CDU
7. Low Noise Amplifier (LNA)/Diplexer
8. Low Gain Antenna (LGA)
9. High Gain Antenna (HGA)

### EQUIPMENT LIST.

<u>SATCOM:</u>	<u>Height (Inches)</u>	<u>Weight (Pounds)</u>	<u>Power</u>
SDU	7.5	20	115 Vac/400 Hz
RFU	7.5	14	115 Vac/400 Hz
HPA	7.5	15	115 Vac/400 Hz

### Data Link:

ACARS	7.5	7	28 Vac 115 Vac/400 Hz
ACARS CDU	4.5	7	115 Vac/400 Hz 5 Vac

### Antenna System:

Low Gain Antenna	5.75	3	---
LNA/Diplexer	2.0	6	115 Vac/400 Hz

### Trays:

(4) ARINC 600	---	---	115 Vac/400 Hz
---------------	-----	-----	----------------

Note: Hz = hertz  
Vac = volts of alternate current

SDU.

The SDU is capable of sending and receiving at various data rates. This unit converts ACARS messages for transmission on the radio frequency (RF) link using satellite protocols and interfaces with the RFU unit.

RFU.

The RFU receives signals from the SDU at baseband and translates it to the appropriate RF. It also converts the incoming signal from the LNA baseband.

ACARS.

The ACARS is the interface that handles the reception and processing of data communications with the aircraft crew.

HPA.

The HPA amplifies RF signals from the RFU under control of the SDU. The HPA is connected through the LNA/Diplexer (DPX) to the antenna and is controlled to maintain the aircraft Effective Isotropic Radiated Power (EIRP) within limits. The HPA is a class C nonlinear amplifier which provides a maximum power output of 60 watts.

CDU.

The CDU receives and sends data to the ACARS unit. This serves as the input/output (I/O) device for the flight crew.

LNA.

The diplexer and LNA are combined into one unit for installation purposes. The diplexer unit couples transmit signals from the HPA to the antenna and couples received signals from the antenna to the LNA unit. The LNA amplifies the very low level L-band signal from the antenna to compensate for transmission line losses to the RFU.

## INSTALLATION

FIGURE 1: AIRCRAFT LAYOUT.

This view of the equipment will give you an idea where the equipment is located in the aircraft, although the aircraft floor is designed to move the equipment any place you may want it. Future flights may contain a high gain antenna, which will be flush mounted to the top of the fuselage instead atop the engine nacelle.

FIGURE 2: SYSTEMS OVERVIEW.

This is a closeup view of the components and how they are laid out on the mounting racks inside the aircraft.

FIGURE 3: SYSTEMS BLOCK DIAGRAM.

This is an over all view of the components and how they are interfaced with each other.

FIGURE 4: SATCOM AVIONICS RACK DRAWING.

The test rack that the components are mounted on contain three shelves: top, middle, and bottom. The components are mounted on these shelves in a way they can quickly be removed if necessary.

FIGURE 5: SATCOM WIRING PRINTS.

Contains over all wiring of complete circuits.

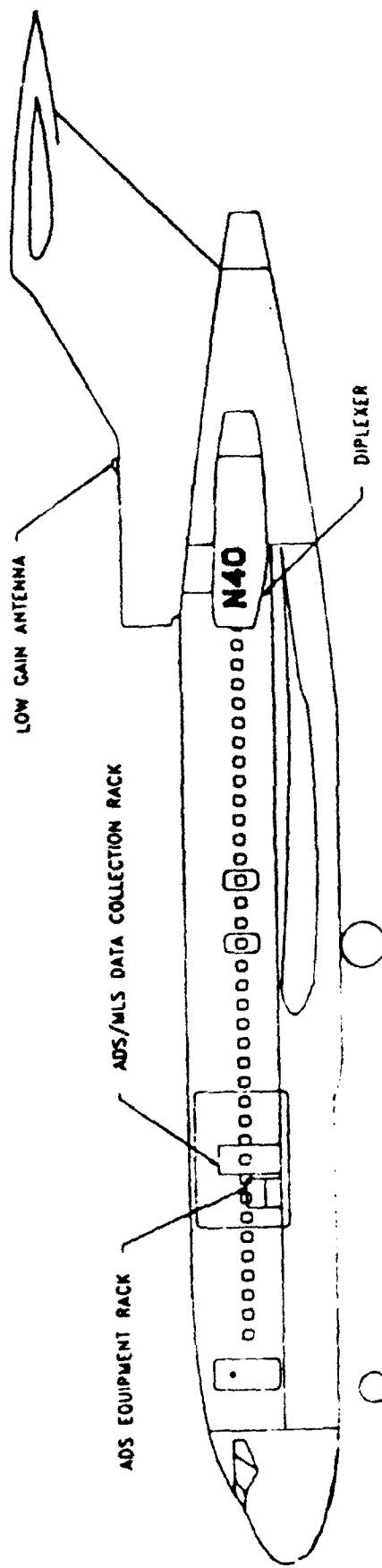


FIGURE 1. AIRCRAFT LAYOUT

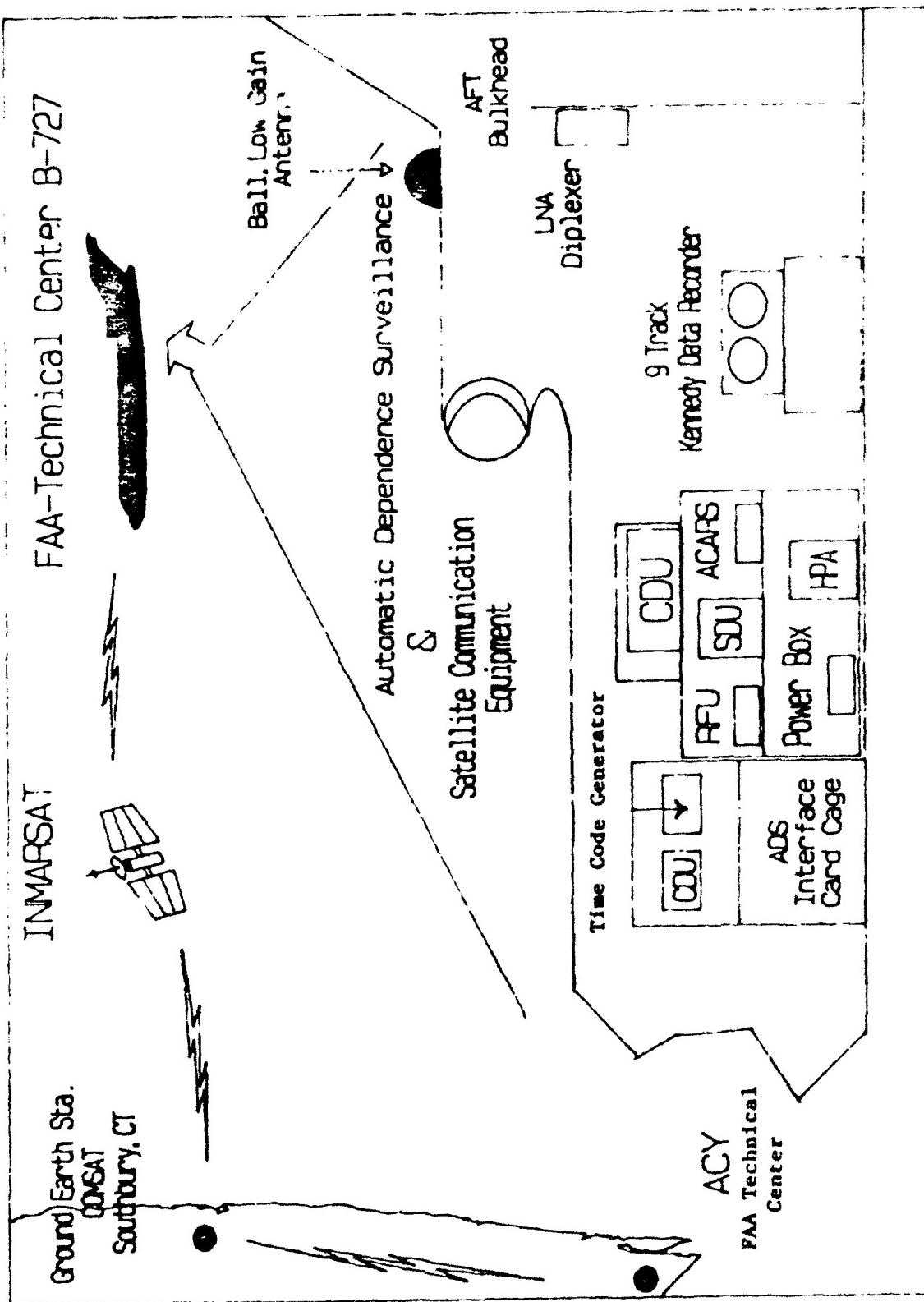


FIGURE 2. SYSTEMS OVERVIEW

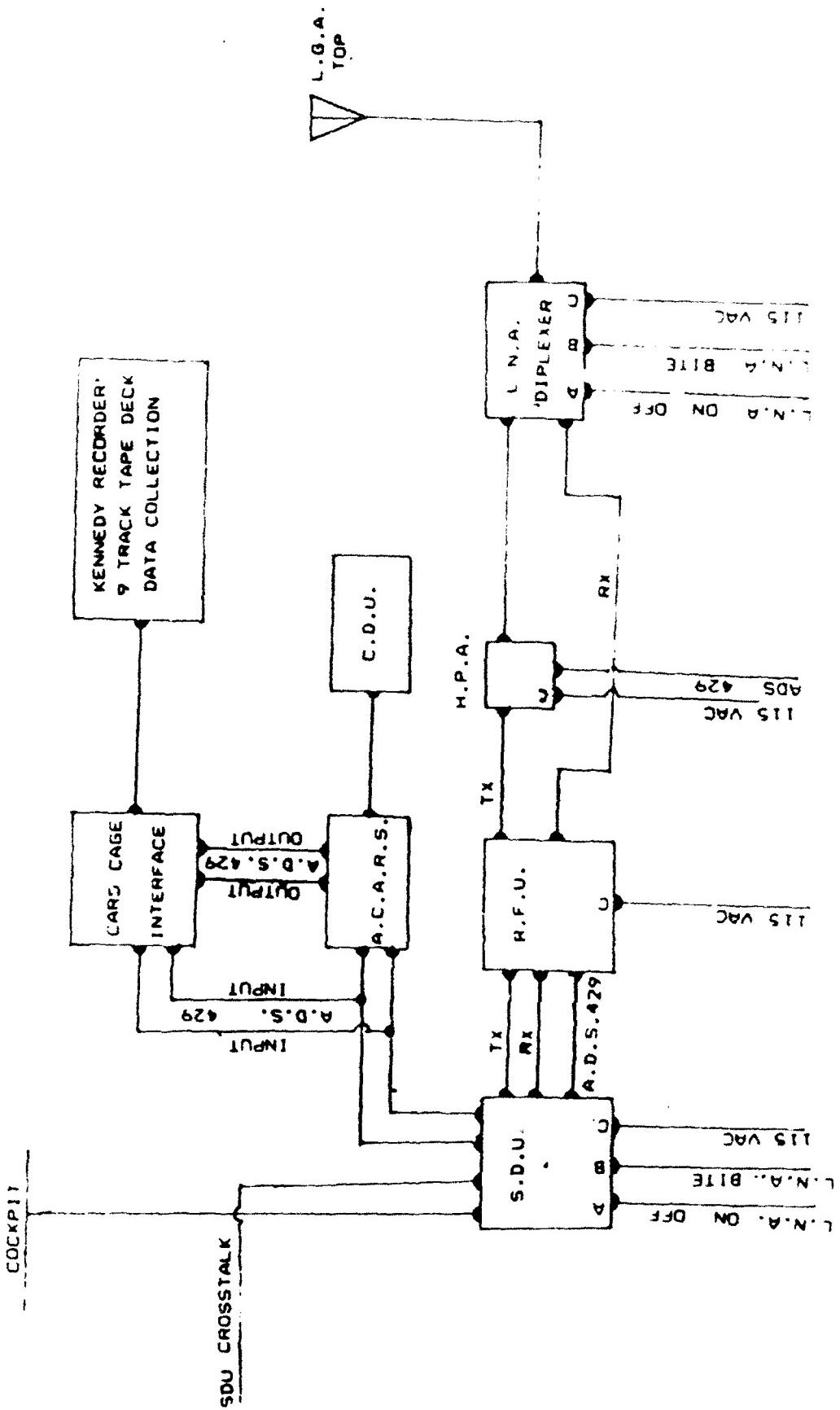


FIGURE 3. SYSTEMS BLOCK DIAGRAM

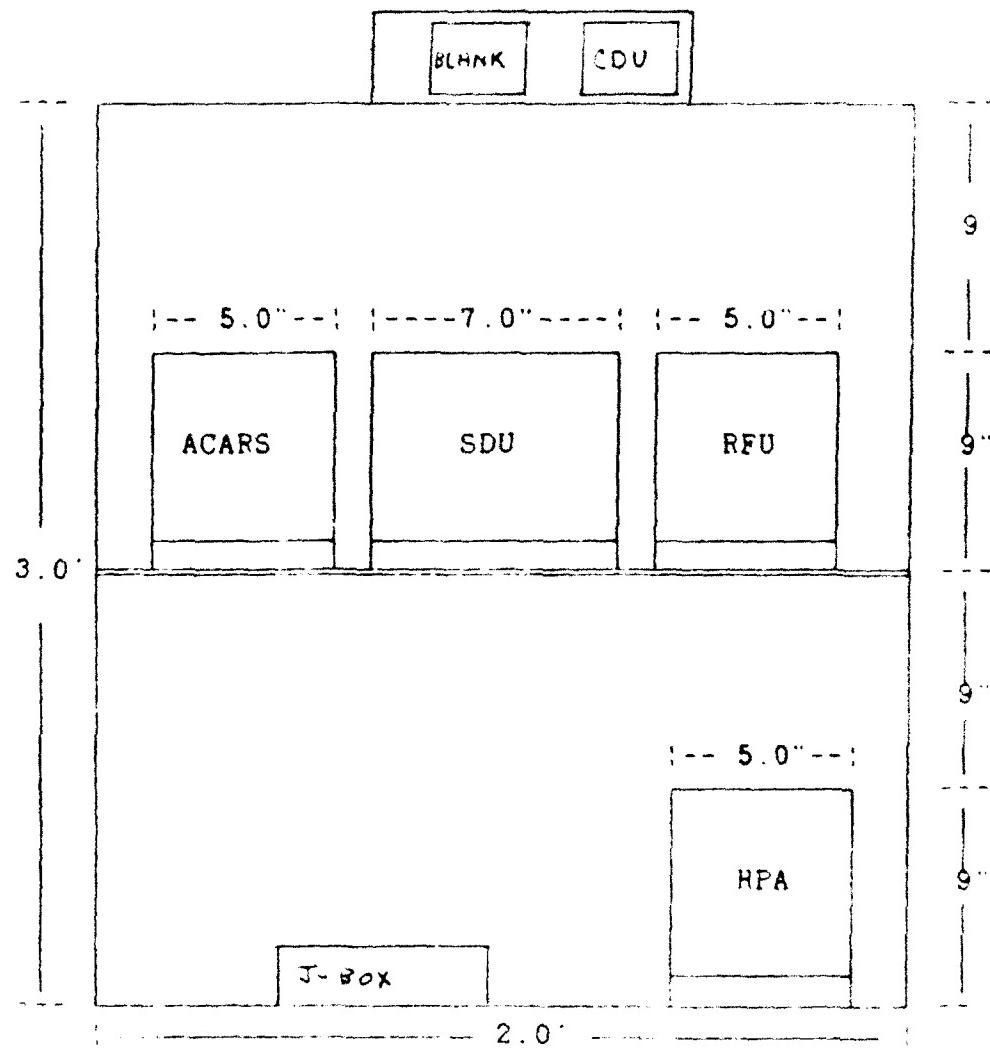
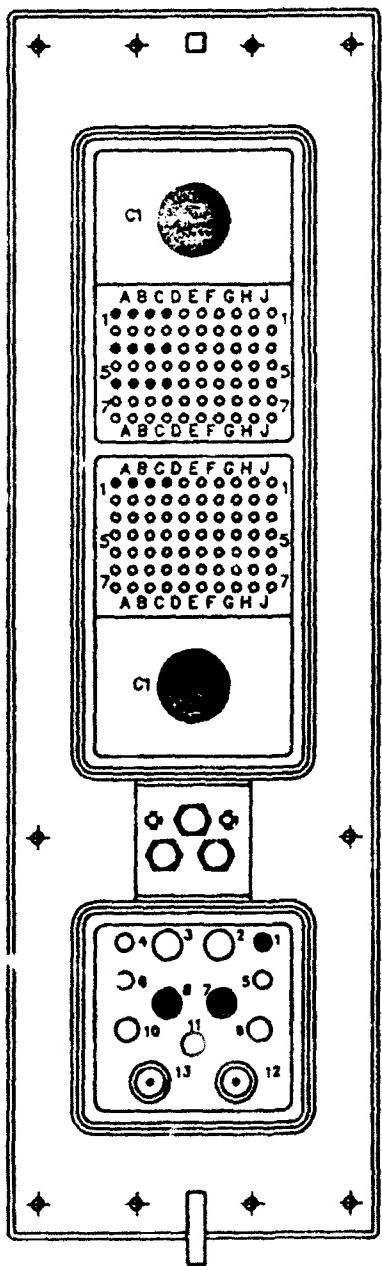


FIGURE 4. SATCOM AVIONICS RACK DRAWING

**COLLINS AIR TRANSPORT AVIONICS**  
**COMPONENT MAINTENANCE MANUAL with IPL**  
**HPA-900 High Power Amplifier**  
**PART NO 622-8850-001**



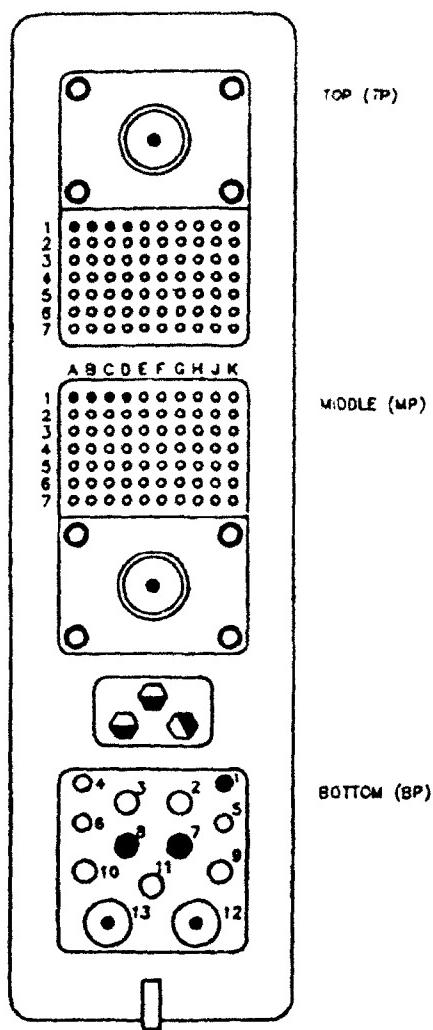
TPC1	RF INPUT
TP1A	MULTICTL A
TP1B	MULTICTL B
TP1C	429 HPA-SDU A
TP1D	429 HPA-SDU B
TP3A	MUTE 1A
TP3B	MUTE 1B
TP3C	MUTE 2A
TP3D	MUTE 2B
TPSA	SDI A
TPSB	SDI B
TPSC	SDI C
TPSD	SDI COM
MPC1	RF OUTPUT
MP1A	RS-232 RCV
MP1B	RS-232 XMT
MP1C	GND
MP1D	RS-232 MON ENABLE
BP1	115 V AC A1
BP7	115 V AC NEUT
BP8	CHASSIS GND

Rear Connector Pin Functions

AD-0638-01

FIGURE 5. SATCOM WIRING PRINTS (SHEET 1 OF 8)

**COLLINS AIR TRANSPORT AVIONICS  
COMPONENT MAINTENANCE MANUAL with IPL  
RFU-900 Radio Frequency Unit  
PART NO 622-8849-001**



**NOTES:**

- ① DARKENED SECTION OF CONNECTOR KEYWAY INDICATES CLOSED PORTION.
- ② CONNECTOR CANNON PART NUMBER BKAD2-V155M401-FO (COLLINS PART NUMBER 859-2004-010) MATES WITH CANNON PART NUMBER BKAD2-V155M-301-FO (COLLINS PART NUMBER 859-3400-010).
- ③ FOR PIN FUNCTION INFORMATION REFER TO CHASSIS INTERCONNECT DRAWING IN THE TESTING AND FAULT ISOLATION SECTION.
- ④ TOOLING INFORMATION: SIZE 22 REAR REMOVABLE CONTACT USE INS/EXTR CIET-22 (CPN 371-8445-020). SIZE 20 USE INS/EXTR CIET-20HDL (CPN 371-8445-040). SIZE 12 INS/EXTR CET-12-4 (CPN 371-8445-XXX). CRIMP TOOL: CONTACTS SHALL BE CRIMPED USING CPN 359-8101-XXX FOR MS22520/1-XX, AND CPN 359-8102-XXX FOR MS22520/2-XX.

CONTACT SIZE	HAND TOOL PART NUMBER	HAND TOOL POSITIONER PART NUMBER	STRIP LENGTH
22	M22520/2-01	M22520/2-23	.130 .100
20	M22520/2-01	M22520/2-08	.167 .147
12	M22520/2-01	M22520/1-11	.270 .230

AD-0666-01

Rear Connector Pin Functions

FIGURE 5. SATCOM WIRING PRINTS (SHEET 2 OF 8)

# SATCOM AVIONICS WIRING \*

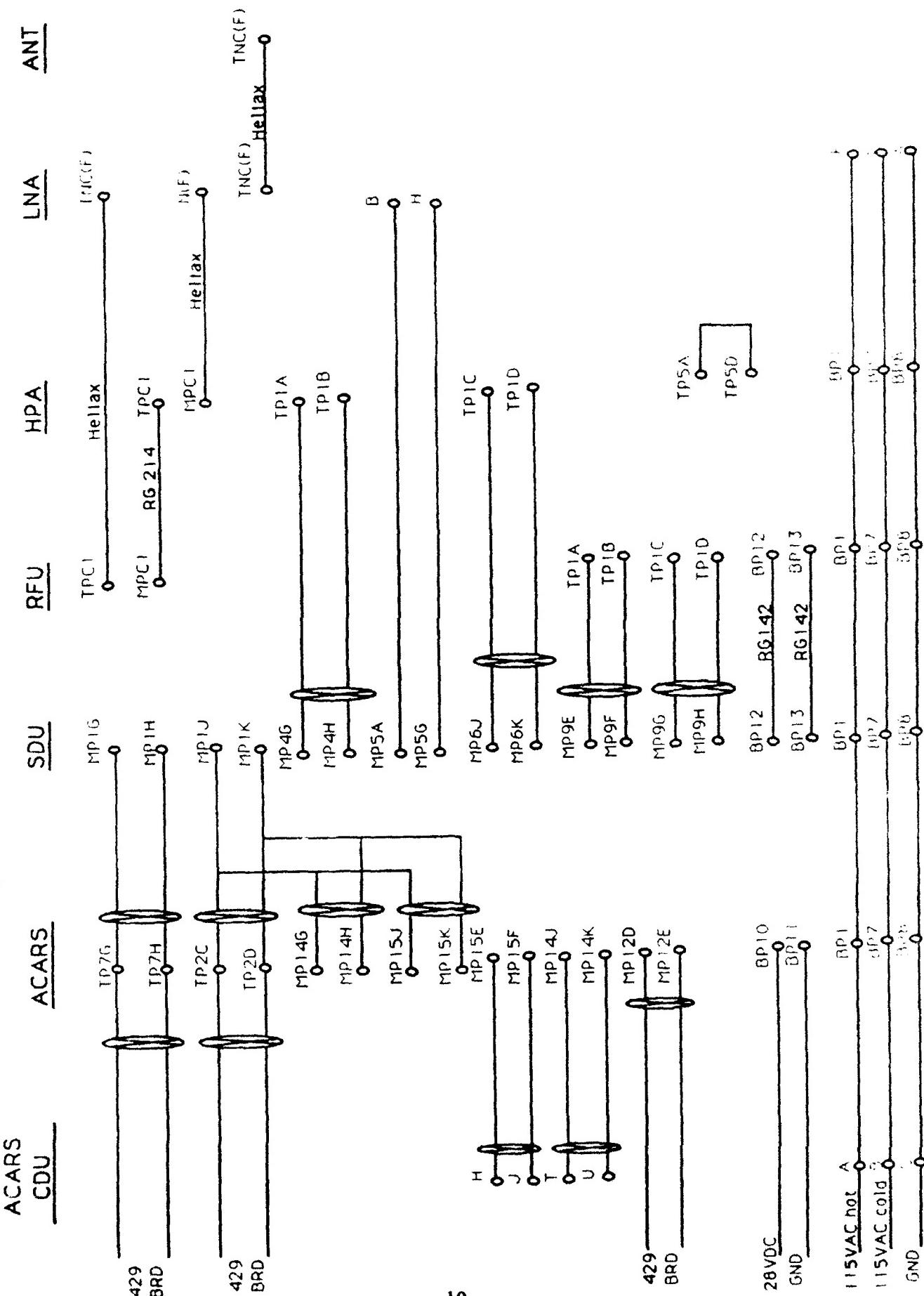


FIGURE 5. SATCOM WIRING PRINTS (SHEET 3 OF 8)

\* All wires are 22 AWG, unless explicitly stated.

# SATCOM / DATA RACK

<u>Signal</u>	<u>MLS/DME Conn.</u>	<u>Avionic Rack Connector</u>	<u>Avionics Rack</u>
	<u>Data Rack</u>	<u>Connector</u>	
	22-55SY	22-55SY	
			<u>ACARS</u>
429 a	d <u>blue</u>	d	TP7G
429 b	e <u>white</u>	e	TP7H
shield	g <u>shield</u>	g	Shield
429 a	h <u>blue</u>	h	TP2C
429 b	i <u>white</u>	i	TP2D
shield	k <u>shield</u>	k	Shield
429 a	v <u>blue</u>	v	MP12C
429 b	w <u>white</u>	w	MP12E
shield	x <u>shield</u>	x	Shield
OUT	y <u>black</u>	y	TP13D
429 a	z <u>white</u>	z	TP13E
429 b	AA <u>green</u>	AA	TP13F
shield	BB <u>Red.</u>	BB	TP13G
ACARS CDU			
			<u>SDU</u>
RS-232			
Tx	CC <u>orange</u>	CC	TP15A
Rx	DD <u>white</u>	DD	TP15B
Common	EE <u>blue</u>	EE	TP15C
			<u>SDI</u>
SW1	<u>white</u>	MP11E	
SW2	<u>green</u>	MP11F	
SW3	<u>yellow</u>	MP11G	
SW4	<u>green</u>	MP11H	
SW5	<u>blue</u>	MP11J	
SW6	<u>red</u>	MP11K	

FIGURE 5. SATCOM WIRING PRINTS (SHEET 4 OF 8)

# SATCOM / DATA RACK

<u>Signal</u>	<u>MLS/DME Conn</u>	<u>Avionic Rack</u>	<u>Avionics Rack</u>
	<u>Data Rack</u>	<u>Connector</u>	
	22-55SY	22-55SY	
429 a	d	d	TP7G
429 b	e	e	TP7H
shield	g	g	Shield
429 a	h	h	TP2C
429 b	i	i	TP2D
shield	k	k	Shield
OUT 429 a	v	v	MP7J
429 b	w	w	MP7K
shield	x	x	Shield
ACARS [	y	y	TP13D
CDU	z	z	TP13E
acars 429a	AA	AA	TP13F
gen. 429b	BB	BB	TP13G
output shield	FF	FF	MP15G
	GG	GG	MP15H
	HH	HH	Shield
			<u>SDI</u>
RS-232			
Tx	CC	CC	TP15A
Rx	DD	DD	TP15B
Common	EE	EE	TP15C
	<u>ADS Conn</u>	<u>Avionic Rack</u>	<u>Avionics Rack</u>
	<u>Data Rack</u>	<u>Connector</u>	
	22-55SY	22-55SY	
SDU [	D	U	MP3C
CDU	C	V	MP3C
	B	S	MP3D
	A	R	MP3K

FIGURE 5. SATCOM WIRING PRINTS (SHEET 5 OF 8)

## DATA RACK INTERNAL WIRING

<u>Card Cage</u>	<u>J-Box</u>	<u>MLS/DME Conn</u>	<u>Signal</u>
		<u>Data Rack</u>	
MLS/DME Board 22-55P		22-55SY	
p	B7	d	429 a ACARS
n	B8	e	429 b ,
m	B9	g	shield
k	B11	n	429 a
j	B12	i	429 b
i	B13	k	shield
 b		v	429 a ACARS
a	L8	w	429 b OUT
Z	L9	x	shield
Z			
 <u>ACARS CDU</u>			
MS -3112 E20-41P			
J	L1	y	
H	L2	z	
T	L3	AA	
U	L4	BB	
A			115VAC hot
B			115 VAC cold
C			ground
 <u>SDU CDU</u>			
J	L17	D	
H	L16	C	
T	L15	B	
U	L14	A	
			SDU
			CDU
 <u>RS-232</u>			
25 D			RS-232
3	L5	CC	+
2	L6	DD	0V
7	L7	EE	Common

**FIGURE 5. SATCOM WIRING PRINTS (SHEET 6 OF 8)**

ADS RACK / N40 CABLE

<u>SIGNAL</u>	<u>ADS RACK</u>	<u>N-40 JUNCTION PANEL</u>
	LNA	MS 3126E12-10PX
On/Off	B	B
Bite	H	H
Shield	C	C
115VAC hot	F	F
115VAC cold	E	E
Ground	A	A
Shield	G	G

FIGURE 5. SATCOM WIRING PRINTS (SHEET 7 OF 8)

Kennedy Tape Deck Wiring

Card Cage	Kennedy
A -----	10
B -----	11
C -----	12
D -----	13
E -----	14
F -----	15
G -----	16
H -----	17
J -----	6
K -----	7
L -----	8
M -----	9
N -----	18
P -----	5
R -----	1
S -----	2
T -----	3
U -----	4
V -----	21
W -----	25
X -----	30
Y -----	35

FIGURE 5. SATCOM WIRING PRINTS (SHEET 8 OF 8)